



AeroTech®

sae.org/aerotech

March 12-14, 2024 | Charlotte, North Carolina

A banner for the AeroTech event. It features a white, sleek aircraft flying over a dark, mountainous landscape under a blue sky. The aircraft has a unique truss-braced wing design. The word 'AeroTech' is written in a large, white, sans-serif font across the middle of the banner. Below it, the website 'sae.org/aerotech' is displayed in a smaller, white, sans-serif font inside a blue rounded rectangle.

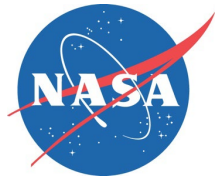
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X-66 Sustainable Flight Demonstrator: A Government/Industry Partnership to Mature Transonic Truss Braced Wing Technology

Brent Cobleigh



Aviation is Vital to our Nation's Economy

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- A large commercial airplane is parked on a tarmac at sunset. The sky is a mix of orange, yellow, and blue. In the background, there are airport buildings and other aircraft. The airplane is white with a dark tail. The tarmac is dark, and there are some ground service vehicles visible.
- 8.97 million flights by U.S. carriers worldwide in 2022
 - 24 million tons of freight transported by U.S. airlines in 2022
 - \$1.9 trillion total U.S. economic activity in 2019
 - \$51.5 billion positive manufacturing trade balance in 2021
 - 2.1 million aerospace/defense jobs; 575,000 in aeronautics/aircraft in 2021

US Aviation Climate Action Plan



U.S. Aviation Climate Goal:

Net-Zero Greenhouse Gas Emissions from the U.S. Aviation Sector by 2050

“The United States believes that addressing the climate crisis through enhanced ambition is a defining priority of our time. This Aviation Climate Action Plan provides a whole-of-government approach and policy framework for the aviation sector to contribute to broader, economy-wide objectives.”

- U.S. Aviation Climate Action Plan



Why invest in Sustainable Flight Demonstrator (SFD)?

- For decades Government, Industry, and Universities have been working advanced commercial aircraft concepts
- To date, these configuration have not made it to market
- NASA launched the SFD project to:
 - Partner with industry to retire as many technical & manufacturing risks as possible
 - Inform industry decisions associated with next generation single-aisle seat class product for 2030s entry into service
 - Maximize the potential to meet environmental goals articulated in the U.S. Aviation Climate Action Plan

Blended Wing Body



Transonic Truss-Braced Wing

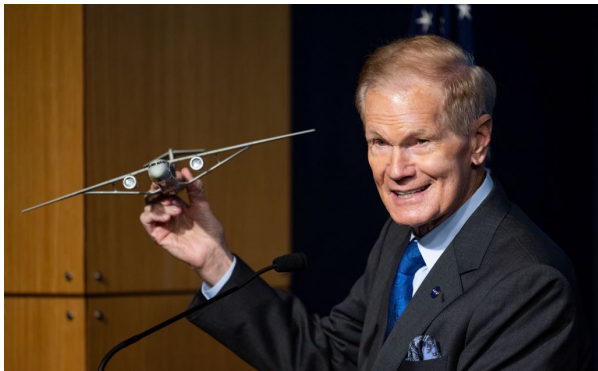
D-8 Double Bubble



Tail-cone Thruster

Industry Partner selected through Competitive Proposals

- Selected Proposal was awarded a Funded Space Act Agreement (FSAA)
- Boeing Company for their Transonic Truss Braced Wing (TTBW)
- NASA providing \$425M in direct payments in addition to significant labor and facility testing resources
- Boeing providing an estimated \$725M
- FSAA provides unique approach for project execution
 - Industry led; NASA supported
 - Industry defines requirements and project plan to maximize learning needed for future product consideration
 - Industry carries risk of cost overrun
 - Industry owns test aircraft
 - Industry has maximum Intellectual Property protection



NASA Administrator
announcing partnership
SFD award

Required Key Learnings

Performance, Stability & Control, and Handling Qualities

- CFD & Aero Performance Validation
- Flutter Characteristics
- Lateral Stability Characteristics
- Typical Flight Envelope Operability

Wing

- Thin Wing Integration
- Relevant High Lift Systems Architecture
- Fuel System Integration

Aeroelasticity

- Tool and Model Validation
- Static Loads Methods Validation



Certification/Crashworthiness

- Strut Fail Safety Requirements
- High Wing/Truss Crush Loads

Structures

- Internal Loads Model Validation
- Primary Architecture & Joint Design Validation

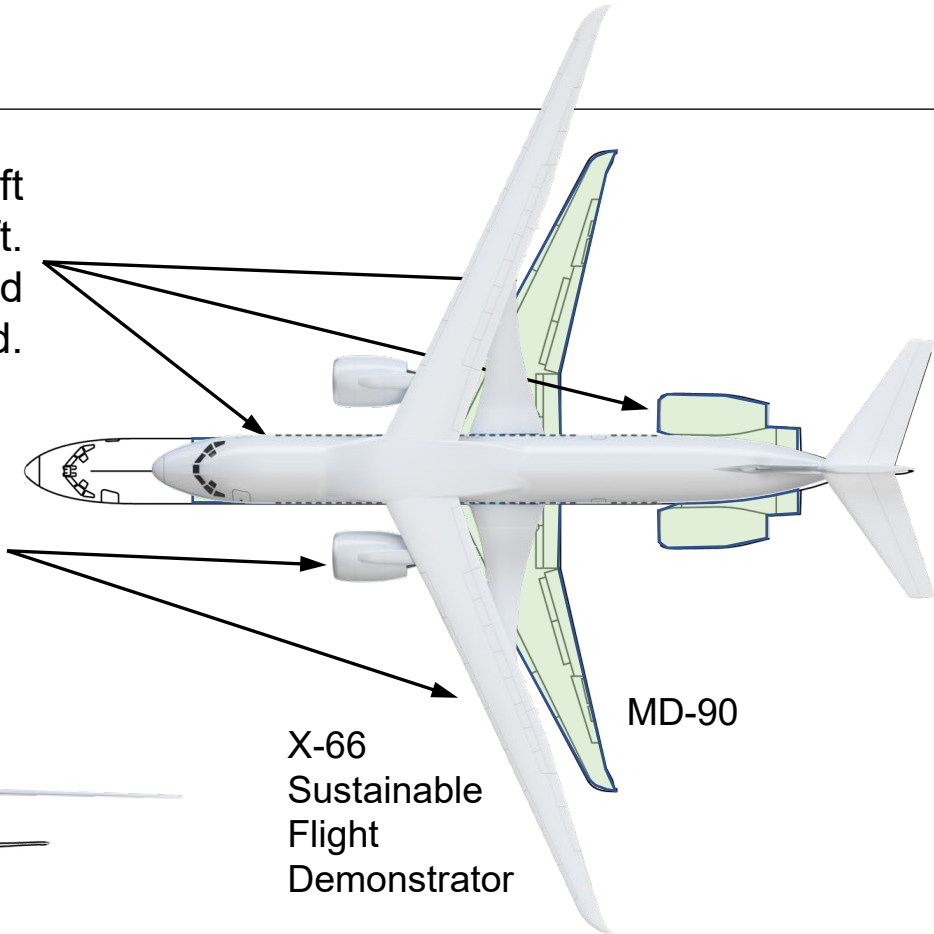
Propulsion- Integration

- SAF Fuel System Compatibility
- Pylon Fail-safe Integration

X-plane Transformation

Boeing will modify MD-90 aircraft into the SFD Demonstrator aircraft.
Existing wings, aft engines, and fuselage sections will be removed.

SFD modification includes addition of
Transonic Truss-Braced Wing and
subsystems, modern, geared turbo-
fan engines, and instrumentation.



NASA's Contributions to SFD

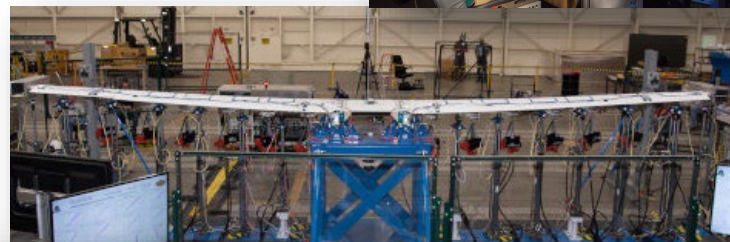
- Major testing support using NASA facilities/capabilities
 - High speed wind tunnel testing (LaRC)
 - Low Speed Deep Stall wind tunnel Test (LaRC)
 - Structural testing of wing strut (AFRC)
 - Piloted simulation (AFRC)
 - Flight test / control room operations (AFRC)
 - Acoustic testing (LaRC/AFRC)
 - Computational Aerodynamics (LaRC/ARC)
- NASA technical support for Boeing-led Integrated Product Teams (IPTs)
 - Engineers
 - Mechanics/Technicians
 - Pilots
 - Program support



**High Speed
Wind Tunnel**



**Piloted
Simulation**



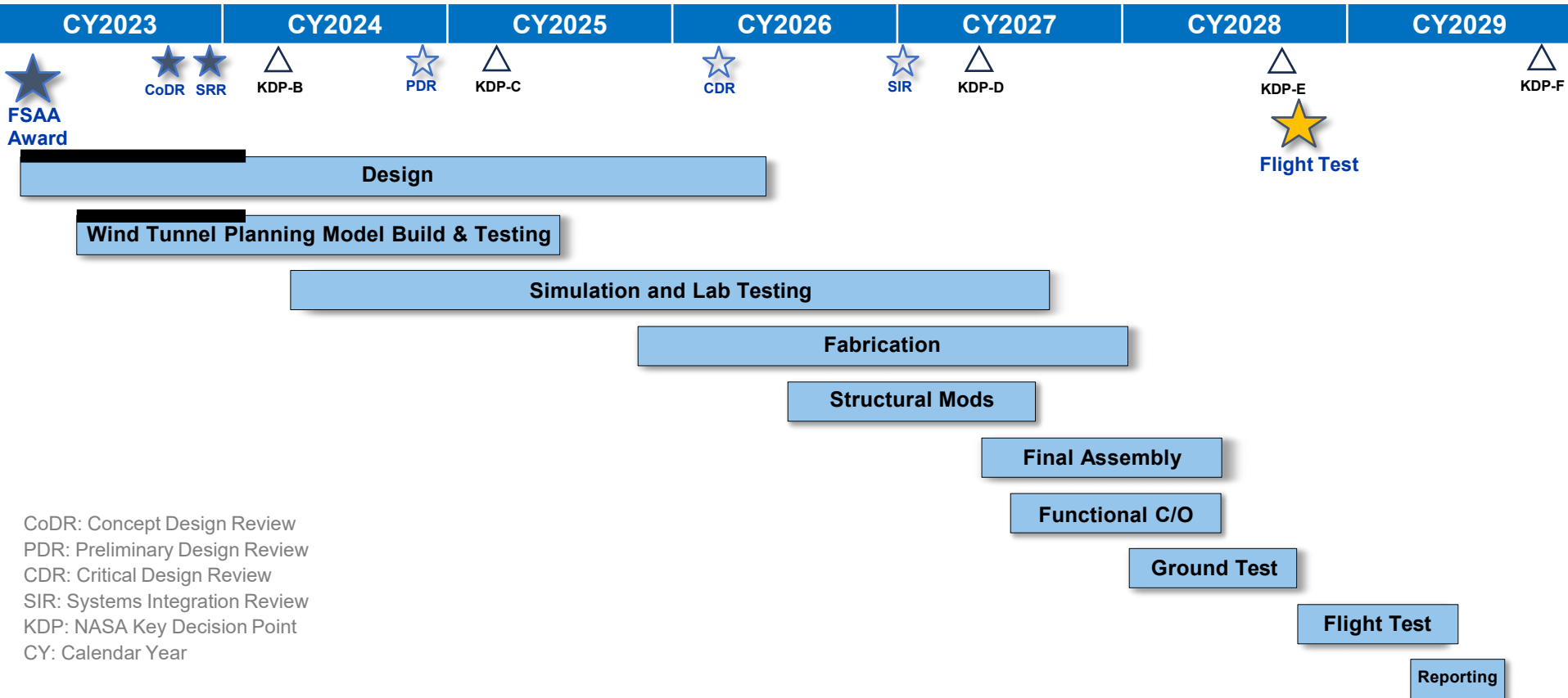
**Structural
Testing**



**Flight
Test
Facilities/
Capabilities**



SFD Project Schedule



SFD Airline Sustainability Coalition



Alaska
American
Delta
Southwest
United



- Boeing has established an SFD Airline Sustainability Coalition to advise their development efforts. The U.S. airlines will offer feedback through all phases of the program, including:
 - **Design:** Airline participants will share feedback on sustainable operations and airport compatibility.
 - **Simulation and lab testing:** Airline pilots will have a chance to experience the X-66 through a flight simulator and assess the vehicle's handling characteristics.
 - **Flight testing:** Airline operations and maintenance teams will assess the X-66 as modifications are made to the airplane.

Contact Info

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National Aeronautics and
Space Administration

